REMARKS

1. Status of the Claims

Claims 6–14 and 21–27 were pending in the application. The Office communication states that claims 6–14 and 21–27 are withdrawn from consideration. With this Amendment, claims 6–14 and 21–27 have been cancelled without prejudice, and new claims 28–37 have been added. Support for new claims 28–37 is found in the originally filed specification, including the originally filed claims. No new matter has been added. Upon entry of the present amendment, claims 28–37 will be pending.

New independent claim 28 is directed to a nano carbon ball comprising a mesoporous shell and having a hollow core, wherein the mesoporous shell has a thickness of 50 nm to 500 nm and said hollow core has a diameter of 10 nm to 1,000 nm, wherein the mesoporous shell comprises carbon, and wherein the nano carbon ball is impregnated with at least one metal composition selected from the group consisting of a transition metal, a transition metal oxide, an alkali metal salt, and mixtures thereof. Support for new claim 28 is found in the originally filed specification, for example, at p. 2, ll. 9–18; p. 4, ll. 5–8; p. 5, ll. 24 to p. 6, ll. 2; p. 6, ll. 21 to p. 7, ll. 5. Therefore, no new matter has been added.

2. The New Claims Are Not Obvious Over Everett In View Of Hong '808

Applicants submit that new claims 28–37 are not obvious under 35 U.S.C. § 103(a) over United States Patent No. 4,439,349 to Everett et al. ("Everett") in view of KR 1999-0080808 to Hong et al. ("Hong '808"). Neither Everett nor Hong '808, taken singly or in combination, teaches or suggests Applicants' metal-impregnated nano carbon balls. Applicants respectfully point out that Everett does not teach or suggest Applicants' nano carbon balls, said carbon nano ball comprising a mesoporous shell with a thickness of 50 nm to 500 nm and having a hollow core with a diameter of 10 nm to 1,000 nm. Everett's mesoporous carbon is an entirely different structure. Everett seeks to provide a structure have mesoscale size pores by stacking solid spherical carbon particles in an ordered arrangement such that the spaces <u>between</u> the solid particles, referred to as interstitial pores, have the desired dimensions. Specifically, Everett discloses "an adsorbant wide pore carbon comprising a form-stable assembly of a family of contiguous spheroidal (preferably spherical or oblate spherical) carbon particles wherein *the surfaces of adjacent contiguous particles define interstitial pores*" (*see* Everett at col. 1, ll. 61-66, emphasis added). In particular, Everett seeks to overcome the drawbacks of the prior art that did not provide means for

packing carbon particles in a regular assembly (*Id.* at col. 1, ll. 34-40). Everett's form-stable assembly is formed by depositing carbonisable solid polymer particles in the desired arrangement, heating the assembly to cause partial degradation of the polymer to create the contiguous form-stable assembly (*i.e.*, to get the carbon particles to link at a point), and then heating the form-stable assembly to carbonize the polymer (*Id.* at col. 3, ll. 32-51; *see also* the Example at col. 5, ll. 27-68). According to Everett, the size of such interstitial pores "can be changed in a pre-determinable way by selective variation of the size of the particles" (*Id.* at col. 2, ll. 14-16). Specifically, "[t]he useful size of a foramen[1] is a dimension of major importance in that it has a major affect on the ability of material to diffuse into and out from the interstitial pores" (*Id.* at col. 2, ll. 37-40). In sum, Everett has provided an assembly of contiguous solid carbon particles, *i.e.*, particles that touch or contact at a point, such that the space between the particles has a mesoporous pore size, and such that the assembly does not come apart (*i.e.*, the assembly is form-stable).

In the Office Action dated July 10, 2007, the Examiner had asserted that "[s]ince the carbon spheres are made by making a spherical template, polymerizing a carbonizable polymer over the template, and then carbonizing the carbonizable polymer and degrading the template (example), which is the same as the method of instant specification, the carbon spheres of the art are understood to be hollow, and to have a shell size commensurate with that of instantly claimed carbon spheres." Applicants respectfully disagree with the Examiner' assertion that Everett teaches degrading a template to produce hollow carbon spheres. As pointed out above, Everett teaches heating the assembly of deposited polymer particles to cause *partial* degradation of the polymer in order to create the contiguous form-stable assembly, *i.e.*, to create an assembly where the spheres does not separate (*see, e.g.*, *Id.* at col. 3, ll. 32-51; *see also* the Example at col. 5, ll. 27-68). Furthermore, Everett's carbon particles are not hollow. Everett provides an assembly having <u>interstitial pores</u> between solid carbon particles by stacking an arrangement of polymer particles and producing a non-separable contact between the solid particles. Therefore, one of ordinary skill in the art would have no reason to derive Applicants' nano carbon balls based on the disclosure of Everett's form-stable assembly of solid carbon particles. Thus, Everett does not teach or suggest Applicant's claimed nano carbon balls. Furthermore, the disclosure in Hong '808 of impregnating microporous activated carbon systems does not cure the deficiencies of Everett.

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1 Webster's Seventh New Collegiate Dictionary (1970) defines a foramen as: "a small opening, perforation, or orifice" (*see* page 326).

Therefore, Applicants submit that the combined teachings of Everett and Hong '808 do not render obvious Applicants' claimed metal-impregnated nano carbon balls.

Accordingly, for at least these reasons, new claims 28-37 are not obvious under 35 U.S.C. § 103(a) over Everett in view of Hong '808.

3. <u>The New Claims Are Not Obvious Over Dille In View Of Hong '808</u>

Applicants submit that new claims 28–37 are not obvious under 35 U.S.C. § 103(a) over United States Patent No. 3,531,265 to Dille et al. ("Dille") in view of Hong '808. Neither Dille nor Hong '808, taken singly or in combination, teaches or suggests Applicants' claimed metal-impregnated nano carbon balls. Applicants respectfully point out that Dille does not teach or suggest Applicants' nano carbon balls, each carbon nano ball having a mesoporous shell having a thickness of 50 nm to 500 nm and a hollow core having a diameter of 10 nm to 1,000 nm. Dille teaches a method of removing entrained particulate carbon from the gas stream of raw synthesis gas for re-use as feedstock to produce more synthesis gas (*see* Dille at col. 2, ll. 40–46). The particulate carbon is a by-product from the production of the synthesis gas (*Id.* at col. 1, ll. 57–67). Dille's synthesis gas is produced by partial oxidation of a feedstock comprising a mixture of hydrocarbon oil and a concentrated iron hydroxide flocced carbon-water slurry at a temperature of 1800-3000°F (*Id.* at col. 1, ll. 11–27 and col. 3, ll. 40 – col. 4, ll. 9). That is, Dille's synthesis gas is formed from the combustion of a hydrocarbon. Dille's particulate carbon is one of the by-products of the combustion process, *i.e.*, a result of the incomplete combustion of the hydrocarbon (col. 4, ll. 10–16). As disclosed in Hong '808, a simple activated carbon is a solid substance obtained by incomplete combustion of hydrocarbons (*see* Hong '808 at page 4, ll. 23 to page 5, line7). Therefore, according to the description in Hong '808, the by-product particulate carbon disclosed in Dille is an activated carbon. As a result, Applicants' nano carbon balls would not be rendered obvious based on the disclosure of Dille's activated particulate carbon. The Examiner asserted in the Office Action dated July 10, 2007 that Dille's particulate carbon is understood to be a mesoporous carbon based on its particle size and its high surface area. But as disclosed on page 5, ll. 1–5 of Hong '808, an activated carbon has a tremendously large surface area, even though it does not have a mesoporous structure. That is, the disclosure in Dille of a high surface area does not necessarily mean the material is a mesoporous carbon, especially given that Dille's by-product particulate carbon meets the description of an activated carbon in Hong '808. Furthermore, Applicants' nano barbon balls is at least about 110 nm in diameter (*i.e.*, a mesoporous shell about 50 nm thick surrounding a hollow core

about 10 nm in diameter), which is much larger than Dille's 70 nm particulate carbon. As disclosed on page 3, ll. 17–19 of the application, Applicants developed the metal-impregnated nano carbon balls for deodorization to overcome the limitations of impregnated activated carbon, where the deodorizing ability tends to deteriorate due to clogging of the pores. Therefore, the disclosure in Hong '808 of impregnating microporous activated carbon systems does not cure the deficiencies of Dille. Applicants submit that the combined teachings of Dille and Hong '808 do not render obvious Applicants' claimed metal-impregnated nano carbon balls.

Accordingly, for at least these reasons, new claims 28-37 are not obvious under 35 U.S.C. § 103(a) over Dille in view of Hong '808.

CONCLUSION

Applicants respectfully request that the foregoing amendments and remarks be made of record in the file of the above-identified application. Applicants believe that each ground for rejection has been successfully overcome or obviated, and that all pending claims are in condition for allowance. Withdrawal of the rejections, and allowance of the application, are respectfully requested. If any issues remain in connection herewith, the Examiner is respectfully invited to telephone the undersigned to discuss the same.

No fee is believed due in connection with this response. In the event that a fee is required, please charge any such fees to Jones Day Deposit Account No. 50-3013.

Respectfully submitted,

by: Sandra D. M. Brown

Date: March 31, 2008 for: Anthony M. Insogna

Sandra D. M. Brown (Reg. No. 52,663)
For: Anthony M. Insogna (Reg. No. 35,203)
Yeahsil Moon (Reg. No. 52,042)
JONES DAY
222 East 41st Street
New York, New York 10017-6702
(212) 326-3939